Coastal Engineering Technical Note

DATA COLLECTION AND TESTING TOOL: SAUDAS

PURPOSE: The availability of electronic instrumentation to measure wave height, nearshore currents, and other phenomena has generated a concurrent need for reliable data acquisition systems to acquire, record, and verify the collected data. The Serial Analog Unit Data Acquisition System (SAUDAS) was developed as a real time data acquisition tool for intensive electronic data collection projects in the laboratory and field.

BACKGROUND: Hardware and firmware (software that's been embedded or programmed into hardware) comprise the Serial Analog Unit (SAU). Software program SAUDAS was designed to capture data originating from the SAU. The SAUDAS system (Diagram 1, SAU Technical Reference Manual, 1988) has been used in field and laboratory, collecting data from a wide variety of instrumentation, such as Marsh McBirney electromagnetic (EM) current sensors, Paroscientific pressure gages, optical back scanners, accelerometers, strain gages, and other analog data gathering devices. The software was first developed for use with PC-DOS. The design has been modified for the VAX/VMS operating system, making the software usable on the DEC family of computers, including the 700 series and Micro VAXes.

HARDWARE SETUP

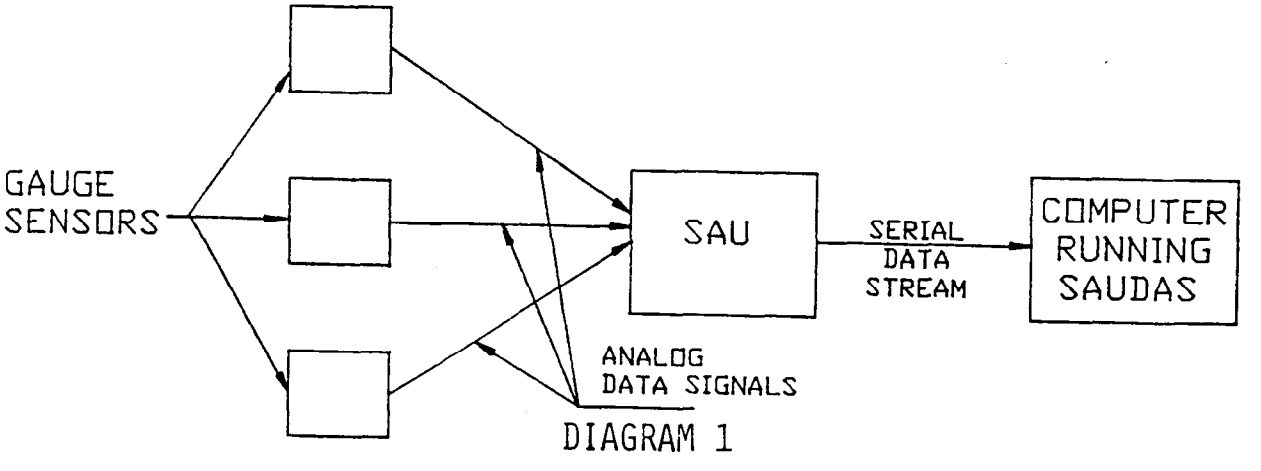

DIAGRAM 1

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DESIGN: SAUDAS captures serial data from a standard RS232-C port on the host computer (Quinn, 1986). The software checks the incoming data to ascertain possible data loss by using a synchronization technique. A predetermined number of data channels (8-26) which is user selectable are used to transfer the data from sensors to SAU. The SAU digitizes sensor analog data, inserting two synch characters into the serial data stream sent to the host. This method simplifies identification and documentation of data loss. The user establishes an experiment-specific parameter file which enables the software to write the data stream to a disk file. Data may be obtained from multiple SAU's if the computer operating system permits multitasking operations.

SAUDAS software interfaces are designed for automated or interactive data collection. In batch or automated mode, data are taken for an arbitrary sampling period at regular intervals. An example experiment might require that twenty minutes of data be taken every hour. For interactive sampling, the investigator picks a larger sampling period and can interrupt data collection when experiment conditions warrant. File naming conventions are based on collection startup time for either method.

EXAMPLE APPLICATIONS: The East Pass 87 Study (29 Sep - 1 Oct 1987) used a MICRO VAX/VMS operating system (SAUDAS Operations Manual, 1987). The hardware setup (Diagram 2, from SAU Technical Reference Manual, 1988) consisted of one SAU connected to two tripods containing one current meter and one pressure gauge each. A portable PC (not shown) was attached to the beach station (SAU) to monitor the incoming data. While not required for the collection effort, this option provided a further safeguard to assure successful data collection. Based on the nature of the data to be collected, and the length of the experiment, the investigator decided on interactive data collection, with a sample rate of 5 Hz. The experiment parameter file was set up for thirty-five minutes, and data collection runs were interrupted after approximately twenty minutes. A graphics interface was used to verify data acquisition. One hundred percent data recovery was achieved in the two experiment runs performed.

SAU HARDWARE SETUP

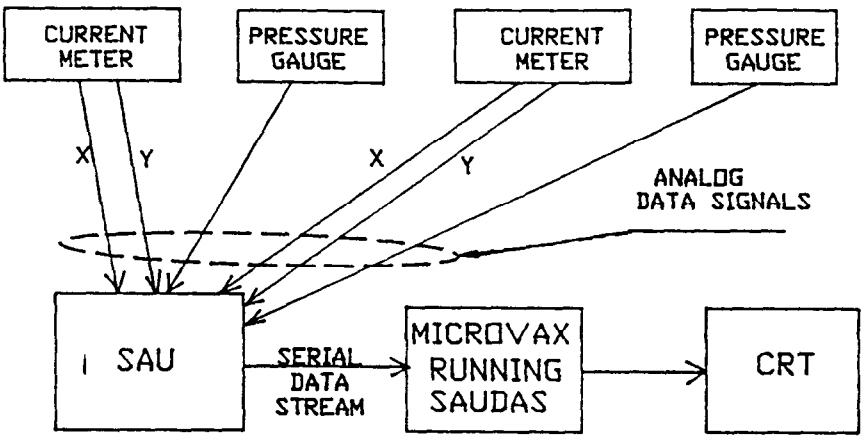
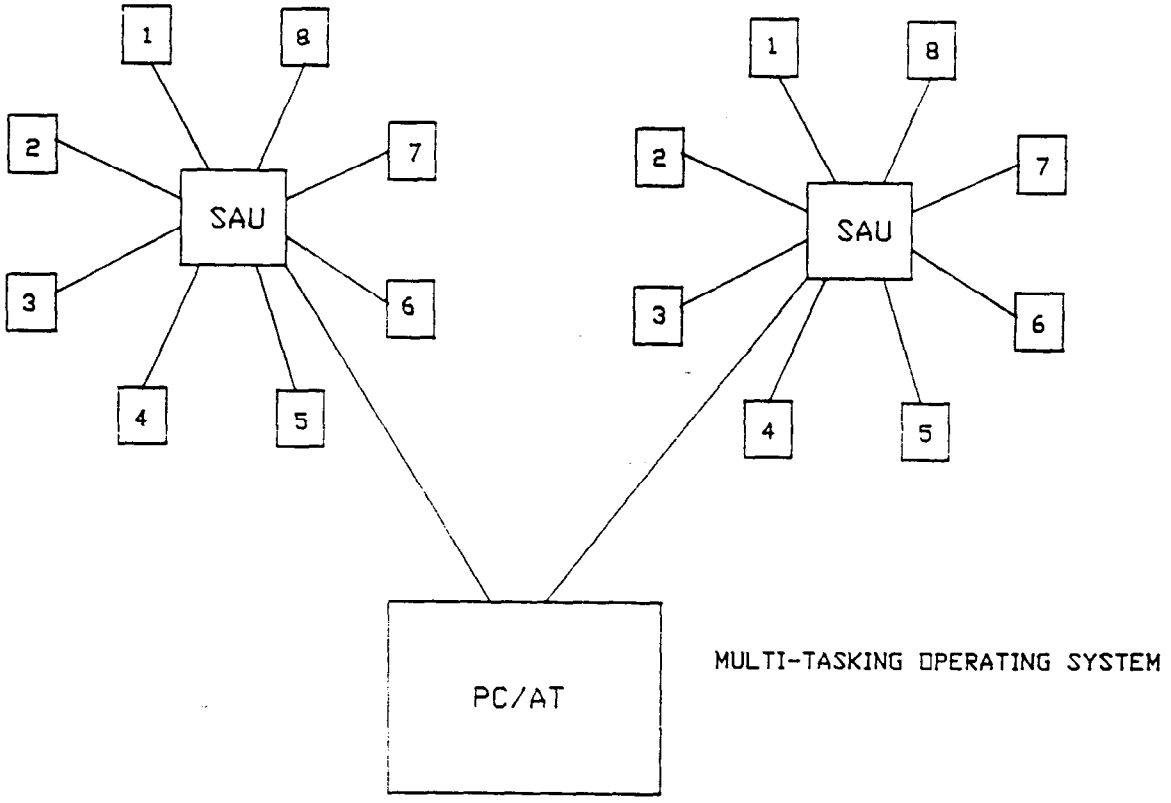


DIAGRAM 2

For the SUPERDUCK 86 Experiment,(6 - 24 Oct 1986) five optical back scanners, one pressure sensor and two signals from an EM meter were arranged with one data channel per sensor/signal, and eight channels (sensors) per SAU, with simultaneous data collection from two SAUs. (Diagram 3, from SAU Technical Reference Manual, 1988). A multi-tasking operating system running on a PC/AT allowed simultaneous data collection from more than one unit. Data were collected in batch mode for thirty-seven minutes at 5 Hz every hour. The experiment parameter file was set for a specified number of data files corresponding to the number of days in the experiment. Backups of data files were done on a daily basis, between data runs. The experiment ran for 19 concurrent days and 95 percent data recovery was achieved.

FIELD SIMULATION: During the software testing phase for the Micro VAX operating environment, East Pass 87 Study (Saudas Operations Manual, 1987), pressure gages and current meters were set up in the intended field configuration in the laboratory, for instrumentation testing and software validation. The gages were placed in a water flume and current introduced into the flume. This procedure provided simulated data for testing the graphics interface. An Interactive Laboratory Software (ILS) graphics interface was developed to give the investigator the capability to convert raw data to engineering units and view the data graphically upon completion of the data collection run. The ILS graphics interface facilitated rapid validation

of the field setup, enabled laboratory testing of the SAUDAS system, and provided a practical method of testing the field instrumentation. The system thus facilitated rapid systems analysis. An equipment specialist was able to "tune" the EM current meter signal to within ten to fifteen millivolts, permitting the elimination of system noise transmitted through the wiring system, while monitoring the performance of the gages. This training and orientation allowed the engineers and technicians involved in the experiment to review the instrumentation setup prior to the field trip. The field computer operator was able to become familiar with the software interface, and demonstrated the operating system and procedures to the technicians. The field simulation reduced the margin for error in the field, by allowing involved personnel to become familiar with the overall data collection system.



1 OPTICAL BACK SCANNER SENSOR
2 OPTICAL BACK SCANNER SENSOR
3 OPTICAL BACK SCANNER SENSOR
4 OPTICAL BACK SCANNER SENSOR
5 OPTICAL BACK SCANNER SENSOR
6 X CURRENT [EM METER]
7 Y CURRENT [EM METER]
8 PAROSCIENTIFIC PRESSURE SENSOR

DIAGRAM 3

CONCLUSION: SAUDAS is a field-proven system which is highly adaptable and easily tailored to accommodate data collection requirements. It is useful not only as a data collection system, but also as an instrument testing tool. Future refinements will allow real-time viewing of data. This enhancement will give the investigator additional power and latitude in obtaining field data and monitoring the data stream to detect malfunctioning instruments. This refinement will also allow real-time monitoring of field instrumentation prior to deployment. SAUDAS has been used at SUPERDUCK 86, East Pass 87, and CERC's Field Research Facility, with future use slated for 1988 Surf Zone experiments, Monitoring Completed Coastal Projects studies, and possible use at the Crescent City Dolosse Study.

POINT OF CONTACT: For further information, contact Mr. Gary Howell at (601) 634-2006, or Mr. Bill Grogg at (601) 634-2096, Prototype Measurement & Analysis Branch (CEWES-CD-P), directly.

REFERENCES:

Quinn, R. A., 1986, "Pascal Calls to DOS, BIOS Implement RS232 Driver", Turbo Tools #2, Personal Engineering & Instrumentation News, pp. 38-39.

SAU Technical Reference Manual, 1988 (in preparation), CEWES-CD-P Internal Technical Reference.

SAUDAS Operations Manual for East Pass 87, 1987, CEWES-CD-P Internal Technical Reference.